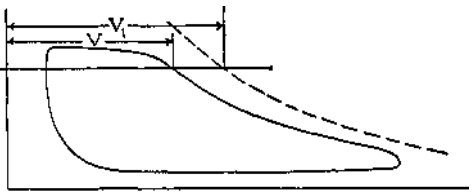
fraction of the contents which consists of vapour, and is called the " dryness fraction " at cut-off. The quantity V^—V is called the " missing quantity ", because it is not shown by the indicator. The total quantity V_t entering the cylinder during each admission period is arrived at by consumption tests taken by condensing the exhaust steam and weighing it. The missing quantity is explained partly by the condensation which takes place during admission, the metal of the cylinder and ports having been previously cooled by the exhaust steam, as explained above.*

The dotted curve is the saturation curve. To obtain points on the curve, take from steam tables the volumes corresponding to various pressures between cut-off and release. Multiply these volumes by (the cylinder feed per stroke + weight of cushion steam). This gives values for V_x in saturation curve. The horizontal distance at any pressure between corresponding points on the expansion curve of the actual indicator diagram and the saturation curve shows the amount of water present, the quantity of steam in the cylinder being assumed to be constant between cut-off and exhaust. In a real engine this condition may not exist, as there may be lea.kage of steam either inwards or outwards through the



Valves Or past the piston. Fig. i.—Single-cylinder Engine Indicator Diagram

A means of reducing the initial condensation, which has been revived and widely used latterly, consists in heating the steam to a temperature higher than that of saturation. Superheated steam will not condense until cooled through a range of temperature equal to the amount of superheat. The colder cylinder metal has less effect, so that the steam tends to remain dry during admission proportionately to the degree of superheat. The thermodynamic equivalent of the available part of the heat added to the steam by superheating would account for a fraction only of the improvement in steam consumption actually obtained. Valve leakage is also considerably

reduced.

The Uniflow type of engine was first proposed by L. J. Todd in his patent of 1887, and his specification shows that he was well aware of the thermal defects "of the ordinary type and of the modifications necessary for improvement. He stated that the object of his invention was to " produce and maintain an improved graduation of temperature extending from each of the two hot inlets to the common central cold outlet, which shall cause less condensation of the entering steam ".

The cycle is as follows. Steam enters through the admission valve, and is then cut off at a predetermined point of the stroke in the usual way. Expansion commences and is continued until about 90 per cent of the stroke

* Other factors affecting the missing quantity are piston and valve-leakage (see Callen-dar and Nicholson, *Proc. Inst. C. Eng.,* Vol. CXXXI, 1897).